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RECOMMENDATIONS FOR INSPECTION, TESTING AND MAINTENANCE OF RADIAL GATES AND THEIR HOISTS

PART 2 INSPECTION, TESTING AND ASSEMBLY AT THE TIME OF ERECTION

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RECOMMENDATIONS FOR INSPECTION, TESTING AND MAINTENANCE OF RADIAL GATES AND THEIR HOISTS

PART 2 INSPECTION, TESTING AND ASSEMBLY AT THE TIME OF ERECTION

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TO
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PART 2 INSPECTION, TESTING AND ASSEMBLY AT THE TIME OF ERECTION

[*Cover page, page* 1 *and page* 3 (*title and clause* 1.1)] — Substitute 'Rope Drum' *for* 'Their'.

(RVD 12)

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(*Page* 7, *clause* **2.7.7**, *line* 1) — Substitute 'correct' *for* 'corrcet'.

(WRD 12)

Reprography Unit, BIS, New Delhi, India

Indian Standard

RECOMMENDATIONS FOR INSPECTION, TESTING AND MAINTENANCE OF RADIAL GATES AND THEIR HOISTS

PART 2 INSPECTION, TESTING AND ASSEMBLY AT THE TIME OF ERECTION

0. FOREWORD

0.1 This Indian Standard (Part 2) was adopted by the Indian Standards Institution on 28 November 1983, after the draft finalized by the Hydraulic Gates and Valves Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Almost every river valley project has a reservoir or diversion work for the control of floods or to store water for irrigation and power generation or for both, and a spillway with spillway gates for release of flood waters during monsoons. Controlled releases of water are also affected by controlled gates provided in conduits in the body of the dam and tunnels. One method of providing such control in spillways and conduits is by radial gates.

0.3 This standard is being published in three parts. Part 1 deals with inspection, testing and assembly at the manufacturing stage. Part 2 deals with inspection, testing and assembly at the time of erection and Part 3 deals with inspection, testing and maintenance after erection.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part 2) lays down the recommendations for inspection, testing and assembly of radial gates and their hoists at the time of erection.

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*Rules for rounding off numerical values (*revised*).

2. INSPECTION

2.1 In order to detect damage and defects, if any, inspection during erection work shall be carried out at the following stages

a) General inspection;
b) Inspection of block outs,
c) Inspection of pier anchorages,
d) Inspection of sill beam;
e) Inspection of wall plates;
f) Inspection of gate; and
g) Inspection of complete gate installation, hoists including electrical items.

2.2 General Inspection

2.2.1 It shall be ascertained that the gate parts received at erection site have been manufactured according to the design and have necessary markings of shop inspection wherever prescribed. It shall be ensured that all exposed surfaces of embedded parts have been protected by painting, greasing, etc, as specified. The surfaces of embedded parts in contact with concrete shall be free from grease, paint, etc, for better bonding with concrete. A coating of cement wash/cement latex may be applied, if necessary.

2.2.2 Dimensional differences, if any, shall be accounted for before erection and the drawings corrected accordingly. For erection the critical dimensions shall be worked out from the drawings.

2.2.3 The reference/centre lines of piers and bays, and levels having relations to completed civil structure shall be established at site so as to facilitate erection at proper locations

2.2.4 It shall be ensured that the various components of the hoisting arrangement, such as motors, reduction gear assembly, switches, wire ropes, etc, are provided according to manufacturer's instructions and erected according to hoist supplier's approved drawings.

2.2.5 The permissible tolerances for embedded parts and components of gate shall be in accordance with Appendix F of IS : 4623-1979*.

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*Recommendations for structural design of radial gates (*first revision*).

2.3 Inspection of Block Outs

2.3.1 It should be ensured that correct block outs are kept for accommodating the embedded parts as manufactured according to the design. It shall also be ensured that the required dowel bars having adequate lengths are left out in the block outs The entire block out is roughened properly for further concreting to give necessary bondage to the second stage concreting.

2.4 Inspection of Pier Anchorages

2.4.1 The inspection of pier anchorages shall be carried out at the following stages

a) Trunnion bracket and support girder,

b) Load carrying anchors or ties and embedded girder (if insulated anchors or ties are used),

c) Anchor girder or yoke girder, and

d) Thrust block/trunnion tie.

2.4.2 The pier anchorages shall be checked with respect to the centre line of the pier and the trunnion axis (line parallel to the crest axis and passing through the centre line of trunnion pins) Control survey marks shall be given on each pier to check the location/alignment of pier anchorages. These shall include the lines parallel to the end at right angle to the dam/barrage axis and a bench mark for level

2.4.3 Centre to centre distance of adjacent piers shall be checked by a steel tape It will be preferable to put a steel girder across the span for taping the distance over the span In case taping is done across the span in air, the steel tape shall be given a predetermined pull.

2.4.4 The trunnion bracket/supports shall be placed on top of a stool and kept in position with the help of struts and their position shall be checked with respect to centre line of pier and trunnion axis A dummy trunnion assembly may be used to check the distance between centre line of trunnion and sill beam centre The slope of the trunnion assembly shall be checked with the help of an inclination gauge

2.4.5 The two trunnion assemblies for each gate shall be checked with respect to each other.

2.4.6 The yoke girder/anchor girder shall be checked for its alignment and slope in both directions For this checking holes may be picked up from dummy trunnion bearing

2.4.7 Before erection the tie bars/rods shall be checked on a level platform for straightness and defects should be rectified if any After erection the slope and spacing of the tie bars,rods shall be checked. For checking the spacing, a spacer gauge shall be used.

2.4.8 After assembly the entire pier anchorage shall be checked The two anchorages for each gate shall also be checked with respect to each other

2.4.9 Before concreting the pier after erection of pier anchorage, it is necessary that a second check of all the parts is made to ensure against any possible displacement during welding, riveting, etc For safety of erected anchorages the grouting/concreting operations shall be commenced after minimum possible interval

2.4.10 For insulated anchors/ties, the insulation shall be provided and checked before starting the grouting/concreting operations

2.5 Inspection of Sill Beam

2.5.1 In case, trunnion assembly is not in position, the dummy trunnion assembly shall be put on adjacent piers and its position should be checked.

2.5.2 Before erection, centre line of sill beam shall be marked on pier faces. The centre line of gate shall be inscribed on the crest shifted by 300 mm or so on upstream side.

2.5.3 The sill beam centre line shall be checked in relation to the trunnion centre line

2.5.4 After erection, the alignment and angular setting of sill beam shall be checked For angular setting of sill beam 3 to 5 frames can be used

2.5.5 After aligning the sill beam, all the bolts and nuts shall be put in position The reinforcement bars and dowels be welded with anchor bolts so that the complete assembly is firmly held in position and is not disturbed during grouting.

2.5.6 The aggregate used for grouting shall not be more than 20 mm. The concrete mix shall be hand-compacted by using rods No mechanical vibrators should be used

2.6 Inspection of Wall Plates (Side Seal Seats)

2.6.1 The wall plates shall be in true alignment with respect to centre line of trunnion pin. The dummy trunnion assembly with extension rods shall be used for checking the alignment of wall plates The verticality of the wall plates should be checked to ensure that wall plates are truly vertical.

2.6.2 After setting of wall plates, all the bolts and nuts shall be put in position. The reinforcement bars and dowels in the block out shall be adequately welded to the side seats in such a manner that wall plates are not displaced during concreting or otherwise

2.6.3 The shuttering planks for concreting the wall plates shall be at least 1 5 to 3 mm clear from the metal parts of the wall plate.

2.6.4 Maximum size of aggregate used for concreting the block outs shall not be more than 20 mm

2.6.5 All concrete mix used shall be hand-compacted and done in conversant stages as the shuttering progresses in upward direction. Compaction may be done by 20 mm rods No mechanical vibrators should be used.

2.7 Inspection of Gate

2.7.1 The subassemblies of the gate which are received at site duly inspected in workshop should be reinspected at site before lowering of assembly in the bay

2.7.2 Checking of all the dimensions of the gate shall be done after skeleton assembly of each gate is made and before final welding/riveting is allowed This dimensional check shall be repeated after welding is done.

2.7.3 Visual inspection of all welds and bolts/rivets shall be made to the extent of 100 percent.

2.7.4 The following critical dimensions should be checked·

a) Centre to centre distance between side guide rollers and shoes,
b) Centre to centre distance between the side seals and bases, and
c) Distance of bottom seal/base from centre line of trunnion pin.

2.7.5 The seal bolts should be tightened adequately and uniformly and the guide wheels be checked for free rotation

2.7.6 To check the effectiveness of the seals, active seal interference should be compared with that provided in the design, because on this aspect will depend to a great extent the efficiency of sealing arrangement and easy operation of the gate.

2.7.7 In case of counterweighted gate it shall be ensured that corrcet weight has been provided.

2.8 Inspection of Complete Gate Installation and Hoists Including Electrical Items

2.8.1 Visual inspection of all gates and hoists shall be carried out after erection.

2.8.2 The erection tolerance shall be checked for all parts during and after erection

2.8.3 In case of hoists, the following points which are by no means exhaustive, need be looked into by engineer-in-charge:

- a) Connections like shaft couplings, connections of wire ropes to the drum and gate, connection of hoist components to the base, etc, have been properly made.
- b) Intermediate supports for shafts are provided at the required locations to permit free movement of shaft,
- c) In case of double hoists both the hoists are properly synchronized;
- d) The ends of wire ropes are properly looped and sufficient 'U' clamps have been provided,
- e) The rope has been tightly wound over the drum, has no kinks and is properly lubricated,
- f) The wire ropes or chains at both ends of the gate and counterweight (if provided) have equal initial tension;
- g) Electric installations have been properly earthed; and
- h) The limit switches have been properly adjusted.

2.8.4 It shall be ensured that the gate sill, wall plates and other embedded parts are thoroughly cleaned and no foreign material is present.

2.8.5 The hoist provided for operation of the gate should first be independently tested when it is not connected to the gate to ensure its satisfactory working. The hoist should be kept running for sufficient period so as to satisfy its independent working Bushings and bearings shall be checked for temperature rise to satisfy that there is no undue friction

2.8.6 Before operation of the gate, the following checks shall be made:

- a) Electric supply and fuses,
- b) Overload relay, if provided, to see that it trips off the starter;
- c) All bearings and wire ropes for proper greasing;
- d) All bolts of gear boxes, hoist drums and shafts, couplings for tightness, and
- e) The oil level in gear reduction unit.

3. TESTING

3.1 The gate shall be tested in a dry condition with hoist duly connected for its smooth working. The gate should be fully closed and fully opened and it should be ensured that there is no obstruction and no undue efforts required for its operation. If the gate is not going down of its own weight or found tight in some position, reasons should be investigated and remedied instead of forcing the gate down

3.2 The testing of gate-seals in dry condition should be done by suitable means, such as by viewing the contact surface against a light source

3.3 In case of rubber seals, water should be poured over the seals so that there will not be dry friction of the seals. In case of metal to metal contacts, oil or grease is to be used. No grease or lubricant is to be used for rubber seals.

3.4 There shall be no noise of friction or any other noise, no signs of excessive friction, no jerky performance, no dug in any position, no dangling of the gate, no twist in rubber seals and rubber seals are not overpressed.

3.5 The gate is to be first kept resting on sill beam, that is in closed position. The leakage test can be done in this position by using suitable pump with necessary arrangements of jetting water at 1.5 times the designed pressure on sealing positions from bottom to top All joints if any, shall be tested to ensure perfect working of the gate

3.6 The gate should be fully opened and closed to ensure full opening and satisfactory closing. The time required for 300 mm opening or closing of the gate is to be recorded.

3.7 The arrangements provided for preventing the travel of the gate or hoist beyond the designed limit are tested and checked for proper working.

3.8 In case of rope drum hoist, it is ensured that the gate moves down of its own weight. The gates shall also go up and down without uneven pull to the gate. The winding of rope over the drum is uniform and according to the design.

3.9 In case of hydraulic hoists, it should be ensured that oil pressures are within the designed limits.

3.10 The full load current required for movement of the gate on load shall be measured and checked against the designed value.

3.11 When the rainy season starts, visual inspection of gates shall be made and they shall be lowered and raised several times to make sure that everything is in order,

3.12 When the water starts overflowing, lower the gates to hold the water to half the height of gates In this position the seals may be tested and any leakage shall be attended to The gates may also be operated up and down with this water load and operation of hoist shall be observed

3.13 The gates shall also be tested in a similar way against full water load.

3.14 During the testing of gate in dry condition (*see* **3.1** to **3.9**) and under water pressure, the following observations shall be made and a record be kept:

a) Movement of gate and indication of jamming, if any;

b) Effective stop is achieved by the gate stops wherever provided;

c) Speed of opening and closing, and the current requirement at specified voltage,

d) Operation of brakes and limit switches;

e) Manual operation of gate, if provided;

f) Efficiency of guide rollers to check the side sway of the gate;

g) Correctness of indication by local position indicators;

h) Synchronization of remote position indicators, if provided; and

j) Vibration of gate, hoist, and civil structure.

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